PATENT

Atty Docket No.: 10018003-1
App. Ser. No.: 10/044,558

IN THE CLAIMS:

Please find below a listing of all of the pending claims. The statuses of the claims are set forth in parentheses.

1. (Currently Amended) A method to identify text-like pixels from an image, the method comprising:

~~(a) providing an image;~~

classifying pixels within a mask within the image as either edge or non-edge, wherein a pixel (i,j) is located at the center of the mask;

determining whether the pixel (i,j) is an edge pixel or a non-edge pixel; and

~~(b) classifying line segments of pixels within the image by~~

performing edge-bounded averaging, wherein the edge-bounded averaging includes[[ing]] finding one of either

an average value of edge pixels having connectivity with pixel (i,j), in response to determining that pixel (i,j) is an edge pixel or

an average value of non-edge pixels having connectivity with pixel (i,j) in response to determining that pixel (i,j) is a non-edge pixel ~~connected pixels within a mask centered at location (i,j)~~.

2. (Currently Amended) The method of claim 1, further comprising:

[[(c)]] examining sub-blobs of pixels within the image; and

[[(d)]] performing sub-blob connectivity analysis.

3. (Currently Amended) The method of claim 2, further comprising:

[[(e)]] identifying and classifying edges of pixels within the image;

[[(f)]] performing filling to further classify pixels within the image;

[[(g)]] performing consistency analysis of pixels within the image;

[[(h)]] performing pixel connectivity analysis of pixels within the image; and

[[(i)]] identifying text pixels within the image.

4. (Canceled).

5. (Original) The method of claim 1, further comprising performing color space conversion of the image.

6. (Original) The method of claim 1, further comprising smoothing the image.

7. (Original) The method of claim 1, wherein a Gaussian lowpass filter is applied to the image, the filter being

$$f_{i,j} = ke^{-\alpha^2\left[(i-c)^2+(j-c)^2\right]/c^2}$$

where k is a normalizing factor such that $\sum_{i,j} f_{i,j} = 1.0$, c is the center of the filter and α =1.0

8. (Currently Amended) The method of claim 3, wherein the step of [[(e)]] identifying and classifying edges of pixels within the image further comprises, ~~wherein~~

classifying every pixel ~~is classified~~ as NON EDGE, WHITE EDGE or BLACK EDGE.

9. (Currently Amended) The method of claim 8, wherein the step of [[(e)]] identifying and classifying edges of pixels within the image further comprises:

(1) calculating a vertical gradient $G^I_{i,j}$, a horizontal gradient $G^I_{i,j}$, and the magnitude of gradient $M_{i,j}$ using the formula,

$$G^I_{i,j} = (y_{i+1,j-1} + 2y_{i+1,j} + y_{i+1,j+1}) - (y_{i-1,j-1} + 2y_{i-1,j} + y_{i-1,j+1})$$
$$G^J_{i,j} = (y_{i+1,j-1} + 2y_{i+1,j} + y_{i+1,j+1}) - (y_{i-1,j-1} + 2y_{i-1,j} + y_{i-1,j+1})$$
$$M_{i,j} = \sqrt{(G^I_{i,j})^2 + (G^J_{i,j})^2}$$

Where $y_{i,j}$ is a pixel luminance value at an index i,j

(2) calculating a discrete Laplacian (a second directive):

$$L_{i,j} = (y_{i-2,j} + y_{i+2,j} + y_{i,j-2} + y_{i,j+2}) - 4y_{i,j}$$

(3) classifying every pixel as the following:

If $M_{i,j} > T_e$ then

If $L_{i,j} < 0$

Classify pixel at (i,j) as WHITE EDGE

Else

Classify pixel at (i,j) as BLACK EDGE

Endif

Else

Classify pixel at (i,j) as NON EDGE

Endif.

10. (Currently Amended) The method of claim 1, wherein the step of [[(b)]] ~~classifying line segments of pixels within the image by~~ performing edge-bounded averaging further comprises:

starting from a first side of a line proceeding to a second side of the line identifying consecutive segments of pixels as NON EDGE, WHITE EDGE or BLACK EDGE.

11. (Currently Amended) The method of claim 1, wherein the step of [[(b)]] ~~classifying line segments of pixels within the image by~~ performing edge-bounded averaging comprises:

computing the edge-bounded averaging for at least eight locations including both end points of a central interior, both end points of a left edge segment, both end points of a right edge segment, a right end point of a left interior and a left end point of a right interior.

12. (Original) The method of claim 11, further comprising:

classifying the central interior as NON TEXT, BLACK INTERIOR or WHITE INTERIOR based upon the edge-bounded averaging values.

13. (Currently Amended) The method of claim 3, wherein the step [[(f)]] of performing filling to further classify pixels within the image comprises:

classifying segments as NON TEXT; and

examining segments classified as NON TEXT to determine whether they may be reclassified as BLACK INTERIOR, BLACK EDGE, WHITE INTERIOR or WHITE EDGE.

14. (Currently Amended) The method of claim 3, wherein the step of [[(g)]] performing vertical consistency analysis of pixels within the image comprises:

examining pixels not yet classified as NON TEXT to determine whether they are BLACK INTERIOR, BLACK EDGE, WHITE INTERIOR or WHITE EDGE.

15. (Currently Amended) The method of claim 3, wherein the step of [[(h)]] performing pixel connectivity analysis of pixels within the image comprises:

identifying aggregates of pixels having been identified as candidates for text, the aggregates being sub-blobs; and

collecting statistics with respect to each sub-blob, wherein said statistics are selected from the group consisting of total number of pixels, sums of color values, number of border pixels, number of broken border pixels and horizontal run length.

16. (Currently Amended) The method of claim 2, wherein the step of [[(c)]] examining sub-blobs of pixels within the image comprises:

examining each sub-blob to determine whether it is NON TEXT.

17. (Currently Amended) The method of claim 3, wherein the step of [[(i)]] identifying text pixels comprises:

examining each sub-blob to classify each pixel as either a text pixel or a non-text pixel.

18. (Canceled).

19. (Canceled).

20. (Currently Amended) The computer readable storage medium according to ~~method of~~ claim 26, said one or more computer programs further comprising a set of instructions for:

performing pixel connectivity analysis of pixels within the digital image identifying aggregates of pixels having been identified as candidates for text, the aggregates being sub-blobs;

collecting each sub-blobs statistics: total number of pixels, sums of color values, number of border pixels, number of broken border pixels and horizontal run length; and

counting sums of each luminance and chroma.

21. (Canceled).

22. (Currently Amended) The computer readable storage medium according to ~~method of~~ claim 26, said one or more computer programs further comprising a set of instructions for:

performing pixel connectivity analysis of pixels within the digital image by identifying aggregates of pixels having been identified as candidates for text, the aggregates being sub-blobs;

collecting each sub-blobs statistics: total number of pixels, sums of color values, number of border pixels, number of broken border pixels and horizontal run length; and counting sums of each Y, C_r, C_b.

23. (Currently Amended) A system for identifying text-like pixels from an image, the system comprising:

a processor for classifying ~~line-segments-of~~ pixels within a mask within the image as either edge or non-edge, wherein a pixel (i,j) is located at the center of the mask; determining whether the pixel (i,j) is an edge pixel or a non-edge pixel; and performing [[by]] edge-bounded averaging, the edge-bounded averaging including one of either finding an average value of edge pixels having connectivity with pixel (i,j), in response to determining that pixel (i,j) is an edge pixel or

finding an average value of non-edge pixels having connectivity with pixel (i,j) in response to determining that pixel (i,j) is a non-edge pixel

~~connected-pixels-within-a-mask-centered-at-location-(i,j)~~.

24. (Previously Presented) The system of claim 23, wherein the processor also examines sub-blobs of pixels within the image; and performs sub-blob connectivity analysis.

25. (Previously Presented) The system of claim 24, wherein the processor also identifies and classifies edges of pixels within the image; performs vertical filling to further classify pixels within the image; performs vertical consistency analysis of pixels within the image; performs pixel connectivity analysis of pixels within the image; and identifies text pixels.

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26. (Currently Amended) A computer readable storage medium on which is embedded one or more computer programs comprising a set of instructions that when executed by a processing circuit performs a method of processing a digital image, the method comprising:

classifying pixels within a mask within the digital image as either edge or non-edge, wherein a pixel (i,j) is located at the center of the mask;

determining whether the pixel (i,j) is an edge pixel or a non-edge pixel; and

performing edge-bounded averaging, wherein the edge-bounded averaging includes finding one of either

an average value of edge pixels having connectivity with pixel (i,j), in response to determining that pixel (i,j) is an edge pixel or

an average value of non-edge pixels having connectivity with pixel (i,j) in response to determining that pixel (i,j) is a non-edge pixel

~~identifying a segment of connected pixels in the image;~~

~~finding average values of connected pixels of the same type in a neighborhood of the segment; and~~

~~using the average values to classify the segment as text or non-text.~~

27. (Canceled).

28. (Canceled).